Appl. No.: 10/716,651
Amdt.dated 12/15/2005
Reply to Office action of 09/09/2005

Amendments to the Drawings:

The attached sheet of drawings includes changes to Figure 9. This sheet, which includes only Figure 9, replaces the original sheet 9 of 9. In Figure 9, reference numeral **60** has been substituted for numeral **10**, consistent with the specification.

Attachment: Replacement Sheet 9/9

REMARKS/ARGUMENTS

In the Office Action dated September 9, 2005, Claims 1-21 are pending. Claims 16-21, previously withdrawn, are cancelled above. Claims 1, 2, 4-8, and 13-15 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 2,392,858 to McMahan. Claims 1, 2, 4-9, and 12-15 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,595,473 to Nagaoka. Claims 1-3, 7-11, and 15 are rejected under 35 U.S.C. § 102(b) as being anticipated by JP 11-190,201 ("JP '201"). In addition, the Office Action objects to the drawings and specification, and includes suggestions for modifications to the claims.

First, Applicant addresses the various objections. Regarding the objections to the drawings, Applicant is submitting herewith a replacement Figure 9, in which reference numeral 60 has been added to refer generally to the compressor shown in the drawing. This is consistent with the discussion in the application at page 11, line 25 – page 12, line 19, and therefore no new matter has been added. Further, with regard to the objection to Claims 6 and 14, these claims are amended above and no correction to the drawings is required. In particular, Claims 6 and 14 are amended to recite that the first edge of each blade "defines a profile that extends axially and radially." This feature is shown, e.g., in Figure 1 of the present application, and the detailed description of the application specifically states that the term "extend generally radially" can indicate an extension having both a radial and axial component. *See* page 6, lines 25-30. The specification is also amended on page 6, line 3, as suggested by the Examiner, and Claim 11 is amended to incorporate the Examiner's suggested claim language. The Examiner's careful attention to these details is noted with appreciation.

Claim 8 has not been amended to include the word "the" before "blades" in line 3, as this is the first occurrence of the word "blades" in the claim. Also, an additional "brief summary of the invention" has not been added to the specification. Applicant respectfully submits that the specification does provide a summary of the invention and an additional section that is formally titled as a brief summary is not required.

Applicant now addresses the rejections made under § 102(b). Claim 1, as amended, incorporates features previously set forth in Claims 3 and 5. In particular, Claim 1 is directed to

a turbine wheel that is configured to be rotated with the flow of gas through a housing. The turbine wheel includes a body portion and blades extending radially outward therefrom. Each blade defines a generally radial first edge and a generally axial second edge that is a leading edge with a nonlinear, concavely curved profile in radial-axial projection. As described in the present application, the nonlinear, concavely curved profile of the second edge can reduce the strain that is induced in the blade "due to the cyclic aerodynamic excitation forces on the blade." Page 8, lines 12-15.

Claim 3 (now incorporated in Claim 1) was rejected solely as being anticipated by JP '201. JP '201 is directed to a turbine with an impeller that has an overhung part 3b. As described in the translation of the Abstract of JP '201, the overhung part 3b has an angle of sweep back or a cutout part" such that "a screw type vertical vortex" results and "supplies a flow high in total pressure" to restrain peeling on the impeller. For example, as illustrated in Figure 1 of JP '201, the leading edge of the impeller vane 3a (other than the overhung part 3b) extends horizontally and the overhung part 3b has an angle of sweep back. Thus, "[a]t the time when [the] turbine is driven at a design point, a relative inflow angle and an inlet blade angle of exhaust gas to the impeller 3 coincide with each other, and exhaust gas smoothly flows along [the] impeller vane 3a. At the time when the turbine is driven separated from the design point, there is made a difference between the relative inflow angle and the inlet blade angle, and when a flow flows in a front edge of the impeller 3a at a large angle of attack, a vortex grow[s] from [the] overhung part 3b. . . ." Translation of Abstract of JP '201. (An Information Disclosure Statement including a translation of the Abstract of JP '201 is being submitted with this Amendment.)

JP '201 does not describe a blade with a second, leading edge that has a nonlinear, concavely curved profile as claimed. Instead, JP '201 merely describes a blade with an overhung part, and no part of the edge is concavely curved. To the contrary, JP '201 illustrates that the overhung part defines an angle. In fact, it is the angle of the overhung part relative to the rest of the inlet blade that apparently results in the formation of the vortex.

Thus, JP '201 does not teach each of the features of Claim 1, as amended, and Applicant respectfully submits that Claim 1 is therefore allowable over JP '201. Further, regarding the

other references cited in the Office Action, neither McMahan nor Nagaoka teaches or suggests the elements of Claim 1, including the features of Claim 3. Indeed, Claim 3 was not rejected over either of McMahan or Nagaoka. Moreover, Applicant respectfully submits that the invention of Claim 1 would also not have been obvious, even in light of a fair combination of the cited references. In particular, it would not have been obvious to modify the angled overhung part 3b of JP '201 to achieve the invention of Claim 1, even in light of the other references, as JP '201 is specifically directed to a turbine impeller with angled portions. It is not even clear from JP '201 that the same effect of restraining peeling could be achieved with a modified design. Further, McMahan and Nagaoka are directed to compressors and do not teach or suggest modifying the leading edges of the blades of a rotor and, in particular, the leading edges of the blades of a turbine rotor.

Independent Claim 8 is directed to a rotary apparatus that includes a rotor configured to rotate with a flow of gas through the housing. The rotor has a body portion and a plurality of blades extending radially outward therefrom. Each blade defines a first generally radial edge and a second generally axial edge that defines a nonlinear profile in radial-axial projection. Vanes are "disposed at circumferentially incremental locations in the housing radially outward from the second edge of the blades such that the blades are subjected to cyclically varying aerodynamic forces as the blades pass in proximity to the vanes during rotation of the rotor. thereby cyclically stressing the blades." Further, the vanes are "adjustable to thereby control the flow of the gas through the housing." Thus, as amended, Claim 8 includes features previously set forth in Claims 9 and 10.

Claim 10 (now incorporated in independent Claim 8) was previously rejected under the sole basis of being anticipated by JP '201. However, the Office Action does not refer to any particular portion of JP '201 as teaching adjustable vanes as claimed, and Applicant finds no such teaching in the reference. Moreover, none of the references teaches or suggests the claimed combination of adjustable blades that are disposed radially outward from a nonlinear edges of the blades of a rotor so that the blades are subjected to cyclically varying aerodynamic forces as the blades pass in proximity to the vanes during rotation of the rotor, thereby cyclically stressing the blades. Accordingly, Applicant respectfully submits that Claim 8 is allowable.

Each of the pending Claims 2, 6, 7, 11-15 is also allowable for the foregoing reasons. Further, the various dependent claims provide additional bases of distinction over the cited references. For example, newly added Claim 22 depends from Claim 1 and further recites that "the second edge defines a smooth and continuous concave profile in radial-axial projection." Claim 23, also dependent on Claim 1, recites that "the second edge defines a concave profile in radial-axial projection, the profile extending smoothly and continuously from a first end to a second end in a generally axial direction, the first and second ends extending radially to a greater extent than a midpoint of the profile between the first and second ends." These features, which are also recited in Claims 25 and 26, are shown, e.g., in Figure 1 of the present application. That is, the nonlinear edge **38** of the blade **32** defines a smoothly curved profile that has a radial extension that is greater at the axial ends of the edge **38** than at the midpoint of the edge **38**. For example, as shown in Figure 1, the second edge **38** can define two axial portions with a concave portion therebetween, the concave portion having a curvature that defines a center of curvature located radially outward of the second edge, a feature recited in Claims 24 and 27. *See* page 8, lines 4-11 of the present application.

For each of the foregoing reasons, Applicant submits that Claims 1, 2, 6-8, 11-15, and 22-27 are allowable over the cited references.

* * * * *

CONCLUSION

The Applicants have made a significant contribution to the art that is neither taught nor suggested by the cited prior art references. In addition, all of the objections and rejections to the claims for formalities have been addressed. Thus it is suggested that the application is now in condition for immediate allowance and such action is respectfully solicited. Should the Examiner have any questions or comments, he is invited to telephone the undersigned to expedite allowance of the application.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of

this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 01-1125.

Respectfully submitted,

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CERTIFICATION OF FACSIMILE TRANSMISSION

I hereby certify that this paper is being facsimile transmitted to the US Patent and Trademark Office at Fax No. (571) 273-8300 on the date shown below.

Grace R. Rippy

December 16, 2005
Date